

FORM PTO-1390
(REV. 5-93)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

**TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371**

196-1187

U.S. APPLICATION NO. (U.S. PAT. & T.M. OFF. FILE NO.)

09/331501

INTERNATIONAL APPLICATION NO.

PCT/DK97/00564

INTERNATIONAL FILING DATE

December 11, 1997

PRIORITY DATE CLAIMED

December 14, 1996

TITLE OF INVENTION

Electric Motor

APPLICANT(S) FOR DO/EO/US

Ole Mathiassen

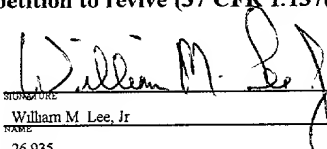
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This express request to begin national examination procedures (35 U.S.C. 371(f) at any time rather than delay examination until the expiration of the applicable time limit set in 37 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☒ has been transmitted by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A FIRST preliminary amendment.
☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information:

Submission of Formal Drawings

U.S. APPLICATION NO (If know, see 37 C R R 1 50)		INTERNATIONAL APPLICATION NO PCT/DK97/00564		ATTORNEY'S DOCKET NUMBER 196-1187	
17. <input checked="" type="checkbox"/> The following fees are submitted: Basic National Fee 37 CFR 1.492(a)(1)-(5): Search Report has been prepared by the EPO or JPO \$840.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) .. \$670.00 No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) \$760.00 Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$970.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) \$96.00				CALCULATIONS	PTO USE ONLY
ENTER APPROPRIATE BASIC FEE AMOUNT =				\$970	
Surcharge of \$130.00 for furnishing the oath or declaration later than _ 20 _ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).					
Claims	Number Filed	Number Extra	Rate		
Total Claims	20 - 20 =	0	X \$18.00	0	
Independent Claims	1 - 3 =	0	X \$78.00	0	
Multiple dependent claim(s) (if applicable)			+ \$260.00	0	
TOTAL OF ABOVE CALCULATIONS =				970	
Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28).				-----	
SUBTOTAL =				970	
Processing fee of \$130.00 for furnishing the English translation later than _ 20 _ 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				-----	
TOTAL NATIONAL FEE =				970	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +				-----	
TOTAL FEES ENCLOSED =				970	
				Amount to be refunded:	
				Charged	
a. <input checked="" type="checkbox"/> A check in the amount of \$ 970 to cover the above fees is enclosed. b. <input type="checkbox"/> Please charge my Deposit Account No. <u>12-0913</u> in the amount of \$ <u> </u> to cover the above fees. A duplicate copy of this sheet is enclosed. c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>12-0913</u> . A duplicate copy of this sheet is enclosed					
NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.					
SEND ALL CORRESPONDENCE TO: William M. Lee, Jr. Lee, Mann, Smith, McWilliams, Sweeney & Ohlson P.O. Box 2786 Chicago, Illinois 60690-2786 (312) 368-1300					
				 <small>SIGNATURE</small> William M. Lee, Jr. <small>NAME</small> 26,935 <small>REGISTRATION NUMBER</small>	

196-1182

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE THE APPLICATION OF)
)
 Ole Mathiassen)
)
 SERIAL NO.: To be Assigned)
)
 FILED: Herewith)
)
 FOR: ELECTRIC MOTOR)

AMENDMENT ACCOMPANYING APPLICATION

Honorable Commissioner of
 Patents and Trademarks
 Washington, D.C. 20231

Dear Sir:

The present application is the national filing of International Application No. PCT/DK97/00564. Before calculation of the national filing fee in the United States, it is requested that the application be amended as follows:

In the Abstract

The abstract is appended hereto, set forth on a separate page.

In the Specification

Page 1, after the title, add the heading - - Background of the Invention - -

Page 2, after line 19, add the heading - - Summary of the Invention - -

Page 7, after line 19, add the heading - - Brief Description of the Drawings - -

Page 8, before line 1, add the heading - - Description of the Preferred Embodiments - -

Page 10, line 22, delete "recesses" and substitute - - holes - -

In the Claims

Cancel claims 1 through 20 without prejudice, and substitute respective new claims 21 through 40 as follows:

21. Electric motor comprising a stator having a bore in which a rotor is located, and having a control arrangement having at least one coil with a core, the coil being loaded by motor current, the core of the coil being located on the stator, and iron of the stator being used for a magnetic circuit.

22. Motor according to claim 21, in which the core is part of the stator.

23. Motor according to claim 21, in which the stator has at least one flux restriction for separation of magnetic flux of the coil on one side and magnetic flux of the stator winding on the other side.

24. Motor according to claim 23, in which the flux restriction comprises at least one hole in the stator, which is filled with a magnetically non- or poorly conducting material.

25. Motor according to claim 24, including a cooling medium in the hole.

26. Motor according to claim 21, in which the core only extends over part of the axial length of the stator.

27. Motor according to claim 21, in which the stator has a substantially rectangular cross section and the coil is located in a corner of this cross section.

28. Motor according to claim 21, in which the stator and the core are formed with laminated sheet plates.

29. Motor according to claim 28, in which the core is formed by the same process used for forming the laminated sheets of the stator.

30. Motor according to claim 28, in which in an axial direction the stator consists of at least two different types of laminated sheet plates having different shapes, of which one has no core forming area.

31. Motor according to claim 21, in which the coil is fitted on a coil carrier shaped to be pushed onto the core.

32. Motor according to claim 21, in which the core is substantially oriented in a radial direction.

33. Motor according to claim 32, in which the core is located in a volume in the stator, which volume is closed by a cover.

34. Motor according to claim 33, in which the cover is welded onto the stator.

35. Motor according to claim 21, in which the core is substantially parallel to one outside of the stator.

36. Motor according to claim 35, in which the core is offset from the outside.

37. Motor according to claim 21, in which the core has the profile of an EI-core.

38. Motor according to claim 21, including several coils, each coil having its own core.

39. Motor according to claim 38, in which at least two of the coils are part coils of a function coil from the group consisting of intermediary circuit coil, filter coil, noise suppression coil or motor coil.

40. Motor according to claim 38, in which the coils are at least two different function coils from the group consisting of intermediary circuit coil, filter coil, noise suppression coil or motor coil.

Remarks

The above amendments are being made in order to eliminate multiple dependency and improper multiple dependency, and also conform the claims to U.S. practice. Should any multiple dependency remain, that is unintended, and the Patent and Trademark Office is requested to cancel all remaining multiple dependent claims without prejudice before calculation of the application filing fee.

June 14, 1999

William M. Lee, Jr.
William M. Lee, Jr.
Registration No. 26,935

Lee, Mann, Smith, McWilliams,
Sweeney & Ohlson
P.O. Box 2786
Chicago, Illinois 60690-2786
(312) 368-6620
(312) 368-0034 (fax)

3 pta

WO 98/29934

09/331501

PCT/DK97/00564

73 Rec'd PCT/PTO 14 JUN 1999

- 1 -

Electric motor

The invention concerns an electric motor with a stator having a bore, in which a rotor is arranged, and with a control arrangement having at least one coil with a core, the coil being loaded by the motor current.

The control enables changes in the supply to the motor of electric current and electric voltage, hereby changing the speed or torque. For this purpose, the control arrangement can be a controlled rectifier, a controlled inverter, a frequency converter etc. Usually, the control arrangement is made as power electronics.

Independently of the exact embodiment of the control arrangement, inductivities are often required, which are realised by way of coils. An example is an intermediary circuit coil, which is loaded by the intermediary circuit current, i.e. the current between the rectifier and the inverter, in a frequency converter. This means that the total current flowing through the motor also flows through the intermediary circuit coil. Another example of a coil loaded by the motor current is a filter coil, which is arranged in the input area of the control arrangement with the purpose of reducing the emission of electrical noise signals. Also output and motor coils could be imagined, which are arranged in the output area of the control arrangement to protect the motor against voltage transients, which could damage the isolation of the motor. The motor current also flows through these coils, even when only the current of one phase is concerned.

Common for all these coils is, however, that due to the relatively large current load they emit a substantial amount of heat and are correspondingly large, meaning that they require much room. As in many cases the control ar-

CONFIRMATION COPY

- 2 -

rangement must be integrated in the motor, i.e. form one unit together with the motor, the placing of the coil represents a problem. To solve this problem DE 36 42 724 proposes that the intermediary circuit coil of a frequency converter is placed in the motor housing in a way that it is axially displaced in relation to the stator and the rotor and surrounds an extension of the rotor shaft. The rotor shaft then forms the core of the coil. The intermediary circuit coil is cooled by the air flow from a ventilator, which is also arranged on the rotor shaft.

This solution is room saving, but still the coil takes relatively much room in the construction of this motor. The motor shaft must be extended by at least the coil width, which means an additional increase of the size of the motor. The extension of the rotor shaft may cause stability problems. Additionally, the magnetic flux through the rotor shaft is difficult to control. There is a risk that undesired mutual influences with the magnetic field of the motor may occur.

It is the task of the invention to arrange the coil in a room or space saving way without causing significant interference with the magnetic design of the motor.

In an electric motor as mentioned in the introduction this task is solved in that the core of the coil is arranged on the stator whose iron is used for a magnetic circuit.

The fact that the iron of the stator is used for the magnetic circuit permits realisation of the desired inductivity of the coil, even when only a limited room is available. However, the iron of the stator is available anyway. The coil is arranged on the outside of the stator, i.e. separated from the stator bore. This does not necessarily mean that the core is fitted on the outside of the stator.

- 3 -

It can also be arranged in the stator, if an access from the outside is possible, at least during fitting. As the iron of the stator "short-circuits" the field lines of both coil and stator winding, a mutual interference does not take place. If a mutual influencing of the fields should occur, it would still be within tolerable frames. As iron is known to be a relatively good heat conductor, the heat produced by the coil can be dissipated relatively fast. It can distribute over the stator, so that the stator surface is available as emitting surface. Also with higher power consumption an overheating is avoided.

In a preferred embodiment the core is part of the stator. Thus the core is made in one piece with the stator, e.g. as a projection of the stator. In this way an air gap is prevented, which would arise by fixing the core on the stator iron, and the magnetic resistance of the magnetic circuit is kept small. The coil can more easily be integrated in the motor.

Preferably, the stator has at least one flux restriction for the separation of the magnetic flux of the coil on one side and of the stator winding on the other side. If the prevention of mutual interference of the fields of coil and stator winding is even more strongly desired, the flux restriction assists in making a measure available, with which this influencing is almost eliminated or at least drastically reduced. The flux restriction increases the magnetic resistance in the surroundings of the coil, and thus screens the field of the coil against the field of the stator winding and vice versa.

In a preferred embodiment the flux restriction is made as a recess in the stator, which is filled with a magnetically non- or poorly conducting material. This recess could e.g. be an air gap. For reasons of stability it could be expedi-

- 4 -

ent to arrange several air gaps next to each other. In principle, the remaining ribs in the iron of the stator permit the penetration of the magnetic field. However, these interferences are negligible.

Preferably, a cooling medium can flow through the recess. This could e.g. simply be cooling air. In case that a fluid cooled motor is concerned, this cooling medium could also be oil or another fluid. Thus the recess does not only screen the magnetic field of the coil from that of the stator winding, it also permits the immediate removal of the heat produced in the coil.

Advantageously, the core only extends over part of the axial length of the stator. Thus the coil size can be adapted to the requirements, without having to change the point where the core is arranged. It is thus not necessary to extend the coil over the whole axial length of the core, even though this is of course possible.

Advantageously, in frontview the stator has a substantially rectangular cross section and the coil is arranged in the area of a corner of this cross section. To improve assembly or generally the handling of motors, the stator has in many cases a rectangular or even square cross section. It is obvious that in the area of the diagonals, i.e. in the area of the corners of this rectangle or square, the stator has a larger diameter, even though this is often not required for magnetic or electrical purposes. This somehow abundant iron and the room can be used for the coil and its core, respectively, which is very space or room efficient.

Advantageously, the stator and the core are formed with laminated sheet plates. This is especially advantageous with motors operated with AC or three-phase current. In a known way, the formation of eddy-currents is prevented.

- 5 -

Further, it is especially preferred that the core is formed by the same sheet blank tool used for forming the laminated sheets of the stator. It is relatively simple to create the shape or profile of the sheets. Normally, such laminated sheets are punched. Providing the punching tool with a corresponding cutting line will enable a relatively simple creation of the shape of the laminated sheets, so that the core will arise automatically when laminating these sheets to assemble the stator.

In this connection it is advantageous that in the axial direction the stator consists of at least two different types of laminated sheet plates having different shapes, of which one has no core forming area. The laminated sheet plates with core forming area then form the core. However, they only extend over a predetermined axial length of the stator, as not all sheets can be made so. The remaining length is then free of such a core. Here the stator then corresponds to a normal motor.

Advantageously, the coil is fitted on a coil carrier which can be pushed onto the core. This simplifies the production. The coil can be prefitted. E.g. it can be wound on the coil carrier, before the coil carrier is pushed onto the core. The coil carrier can e.g. be made of a synthetic material, so that the magnetic properties are not or not significantly influenced. The hereby occurring distance between coil and core can be kept small enough, when the thickness of the coil carrier is reduced.

In a preferred embodiment it is provided that the core is substantially oriented in the radial direction. This orientation is especially recommended, when the core is arranged in the corner area of the rectangular or square cross sec-

- 6 -

tion shape. This provides that a relatively large iron area of the stator is available for the magnetic circuit.

It is particularly preferred that the core is arranged in a volume in the stator, which volume is closed by a cover. Thus, the magnetic circuit can be closed by the cover. Any air gaps remaining between cover and stator are so small, that they can be accepted.

In order to additionally reduce or even eliminate such air gaps, the cover can be welded onto the stator. In this case the coil with core is integrated in the stator. This example clearly demonstrates that the stator with coil does not necessarily have larger dimensions than the stator without coil.

In an alternative embodiment the core is substantially parallel to one outside of the stator. This also enables formation of the desired magnetic circuit.

In this connection it is preferred that the core is arranged offset from the outside inwards. Thus sufficient room will be available on the outside for the admission of the coil windings, without having to increase the external dimensions of the stator.

It is also advantageous if the core has the profile of an EI-core. This facilitates the design, as the calculation opportunities of such cores are known.

Preferably, several of the coils each have their own core. These coils can then be distributed around the stator, or, if each coil does not require the total axial length of the stator, they can be arranged in the axial direction. The decision of using one or more coils depends on the design of the machine.

- 7 -

In a particularly preferred embodiment it can be provided that at least two of the coils are part coils of a function coil from the group of intermediary circuit coil, filter coil, noise suppression coil or motor coil, whereby the motor coils are arranged between the motor connections and the control arrangement. In many cases it can be advantageous, for mechanical, magnetic, electrical or thermal reasons, to divide a function coil, which can in an electrical principal circuit diagram be called a concentrated element, into several, physically separated part coils. This is possible by using several coils.

Alternatively, the coils are at least two different function coils from the group of intermediary circuit coil, filter coil, noise suppression coil or motor coil, whereby the motor coils are arranged between the motor connections and the control arrangement. Then, several of the required coils can be arranged in the stator, without having to increase the dimensions of the control arrangement and the motor.

In the following the invention is described on the basis of preferred embodiments in connection with the drawings, showing:

Fig. 1 a schematic view of a circuit arrangement

Fig. 2 a perspective view of a stator of an electric motor

Fig. 3 a laminated sheet blank

Fig. 4 a field line drawing of a different motor

Fig. 5 various alternative laminated sheet blanks

- 8 -

A circuit arrangement 1 in fig. 1 has a motor 2 and a control unit 3. The control unit 3 is a frequency converter, i.e. it comprises a rectifier 4 supplied via filter coils 5 from a three-phase mains. Via an intermediary circuit 6 the rectifier 4 is connected with an inverter 7 driving the motor 2 via motor or output coils 8. The purpose of the output coils is, e.g., to protect the motor 2 against any occurring voltage transients, which could damage the isolation in the motor 2. The intermediary circuit 6 also comprises an intermediary circuit coil 9.

Both the filter coils 5 and the output coils 8 are loaded by a part of the motor current. In both cases, the part is the current of one phase. The intermediary circuit coil 9 is loaded by the total motor current. Therefore, all these coils 5, 8, 9 must be dimensioned with regard to the currents to be absorbed and the heat thus produced. On one hand this requires much room, and on the other hand it involves certain thermal problems.

Taking the intermediary circuit coil 9 as an example, it will now be explained how such coils can be arranged in the motor 2, without requiring much additional room or without requiring any additional room at all.

Fig. 2 shows the stator 10 of the motor 2, which stator is formed with laminated sheet plates, i.e. numerous sheets piled on top of each other. The piling direction corresponds to the axial direction of the stator 10. Such a plate is shown e.g. in fig. 3.

The stator 10 has several stator slots 12 arranged around a bore 13, in which a rotor is arranged rotatably (not shown in detail). This rotor may be a squirrel-cage rotor. The stator slots 12 also hold the stator winding (not shown),

- 9 -

which produces a circulating magnetic field, which again drives the rotor.

The cross section of the stator 10 has the shape of a square (or an ordinary rectangle), by which, in this case, the corners are bevelled. Correspondingly, the radial extension of the stator iron in the diagonal direction, i.e. in the area of the edges, is larger than in the area of the stator sides.

This fact can be utilised when arranging the intermediary circuit coil 9.

As can be seen from fig. 2 and 3, the sheets forming the stator have a special shape. In the area of the upper right corner (fig. 3) a volume 14 is provided, inside which a core 15 is arranged as projection. The volume 14 can be closed by a cover 16, whose sides 17 can be welded onto the sheets 11. Of course this welding is not made until the sheets 11 have been assembled to form the stator 10. Correspondingly, the production of the volume 14 and the core 15 only requires a corresponding design of the blank tool, viz. a corresponding design of the blank or cutting line. The core 15 practically emerges automatically during manufacturing of the stator 10.

Fig. 2 shows that the intermediary circuit coil 9 is wound on a coil carrier 18, which can be made of plastics and pushed onto the core 15. The intermediary circuit coil 9 can also be prefabricated. By means of projections the coil carrier 18 can then be made so that the wound intermediary circuit coil 9 cannot slide downwards.

The motor is a 7.5 HP, three-phase asynchronous motor. The current flowing into the intermediary circuit 6 after the B6-rectifier 4 has an RMS value of 13.7 A and pulsates at a

- 10 -

frequency of 300 Hz. Correspondingly, the intermediary circuit coil 9 is dimensioned to 1 mH. As appears from fig. 3, the core has the profile of an EI-core. Thus the dimensioning of the coil can be made as with an ordinary EI-core. Correspondingly, the intermediary circuit coil 9 has ten windings. The coil length is 109.5 mm, and the average length of a winding is 265 mm.

The coil wound on the coil carrier 18 is fitted on the core 15 together with the coil carrier 18. Then the cover 16 is fitted on the volume 14 and fixed by welding. Even though an intermediary circuit coil 9 is arranged in the stator 10, the dimensions of the stator are not increased. However, the stator also serves the purpose of distributing and dissipating the heat produced by the intermediary circuit coil 9. The axial length of the intermediary circuit coil 9 is smaller than the axial length of the stator 10. Thus the coil length only covers a share of the total length of the stator. Of course this can be changed to adapt to individual requirements. In the extreme case, the coil might reach the length of the stator 10.

As can be seen from fig. 2 and 3, the sheets 11 have various recesses 19 to 22 in the area of the volume 14. When the sheets are assembled, these recesses 19 to 22 will form channels.

These channels 19 to 22 have two functions. For one they are flux restrictions for separation of the magnetic flux of the intermediary circuit coil 9 from the magnetic flux produced by the stator winding. This separation is simply achieved in that the magnetic resistance between the areas, in which these two fields spread, is increased. The ribs remaining between the channels permit the passing of field lines. However, normally these are negligible. Further, the channels formed by the holes 19 to 22 can also be used as

- 11 -

flow path for a cooling medium, e.g. air, oil or another fluid, or gas, for a quick dissipation of the heat produced by the intermediary circuit coil 9.

To make the function of the flux restrictions formed by the holes 19 to 22 more clear, the field line picture of the magnetic fields of intermediary circuit coil 9 and stator winding 23 are shown in fig. 4. It can be seen that these two fields are substantially isolated, by which the isolation occurs along the recesses 19 to 22. In this embodiment a stator with a different number of slots is shown.

Fig. 5 shows several possible arrangements of the coil 9 in a corner of the stator 10. The coils in figs. a to c are arranged horizontally, i.e. their cores are substantially parallel to a side of the stator. In fig. 5a the core is made in one piece with the stator, i.e. the coil 9 must be threaded after the assembling of the individual sheets.

In fig. 5b the core 15 is a separate unit fitted on the stator 10, e.g. by welding. Other ways of fixing are also possible. Compared with fig. 5b, the core 15 in fig. 5c is a little offset to the inside. Thus the outer contour of the coil 9 does not protrude from the outer contour of the stator 10.

Fig. 5d substantially corresponds to the embodiment according to fig. 2 and 3. Here the cover 16 is welded onto the sides 17 of the stator 10.

Fig. 5e shows an embodiment, in which air gaps 24 remain between a head 25 on the core 15 and the rest of the stator 10. Through the air gaps 24 the coil can be wound on the core.

- 12 -

Fig. 5f shows a solution, in which the coil 9 is fixed on a core 15, which is just a projection on the stator 10. Here the magnetic circuit has relatively large air paths.

All solutions in fig. 5 are provided with flux restrictions (not shown), e.g. as formed by the recesses 19 to 22. In the extreme case it is possible, as shown in fig. 5f, to wind the coil 9 on a core, which is then fixed on the outside of the stator 10.

There is no limitation with respect to placing coils in only one corner of the stator 10. Of course, all four corners of the stator 10 are available for the fixing of coils. It may be expedient to divide one coil, e.g. the intermediary circuit coil, into several part coils, if, for mechanical, magnetic, electrical or thermal reasons, advantages are involved in this. It is also possible to arrange the intermediary circuit coil 9 in one corner and the filter coils 5 or output coils 8 in another corner. Several design opportunities are given here.

Fig. 2 shows that the intermediary circuit coil 9 is arranged at an axial end of the stator 10. However, this is not necessarily required. The intermediary circuit coil 9, and any other coil, can also be arranged in the axial centre of the stator 10. This position can also be expedient for thermal reasons, for improved cooling of the coil on the one hand, and for reducing voltages occurring because of an unevenly distributed thermal load over the length of the stator 10 on the other hand.

- 13 -

Patent Claims

1. Electric motor with a stator having a bore, in which a rotor is arranged, and with a control arrangement having at least one coil with a core, the coil being loaded by the motor current, characterised in that the core (15) of the coil (5, 8, 9) is arranged on the stator (10) whose iron is used for a magnetic circuit.
2. Motor according to claim 1, characterised in that the core (15) is part of the stator (10).
3. Motor according to claim 1 or 2, characterised in that the stator (10) has at least one flux restriction (19 to 22) for the separation of the magnetic flux of the coil (9) on one side and of the stator winding (23) on the other side.
4. Motor according to claim 3, characterised in that the flux restriction (19 to 22) is made as a recess in the stator (10), which is filled with a magnetically non- or poorly conducting material.
5. Motor according to claim 4, characterised in that a cooling medium can flow through the recess (19 to 22).
6. Motor according to one of the claims 1 to 5, characterised in that the core (15) only extends over part of the axial length of the stator (10).
7. Motor according to one of the claims 1 to 6, characterised in that in frontview the stator (10) has a substantially rectangular cross section and that the coil (9) is arranged in the area of a corner of this cross

- 14 -

section.

8. Motor according to one of the claims 1 to 7, characterised in that the stator (10) and the core (15) are formed with laminated sheet plates.
9. Motor according to claim 8, characterised in that the core (15) is formed by the same sheet blank tool used for forming the laminated sheets (11) of the stator.
10. Motor according to claim 8 or 9, characterised in that in the axial direction the stator consists of at least two different types of laminated sheet plates having different shapes, of which one has no core forming area.
11. Motor according to one of the claims 1 to 10, characterised in that the coil (9) is fitted on a coil carrier (18) which can be pushed onto the core.
12. Motor according to one of the claims 1 to 11, characterised in that the core (15) is substantially oriented in the radial direction.
13. Motor according to claim 12, characterised in that the core (15) is arranged in a volume (14) in the stator (10), which volume (14) is closed by a cover (16).
14. Motor according to claim 13, characterised in that the cover (16) is welded onto the stator (10).
15. Motor according to one of the claims 1 to 11, characterised in that the core (15) is substantially parallel to one outside of the stator (10).

- 15 -

16. Motor according to claim 15, characterised in that the core (15) is arranged offset from the outside inwards.
17. Motor according to one of the claims 1 to 16, characterised in that the core (15) has the profile of an EI-core.
18. Motor according to one of the claims 1 to 17, characterised in that each of several coils (5, 8, 9) is provided with its own core.
19. Motor according to claim 18, characterised in that at least two of the coils are part coils of a function coil from the group of intermediary circuit coil, filter coil, noise suppression coil or motor coil.
20. Motor according to claim 18, characterised in that the coils are at least two different function coils from the group of intermediary circuit coil, filter coil, noise suppression coil or motor coil.

Abstract of the Disclosure

ELECTRIC MOTOR

The invention concerns an electric motor with a stator, in whose bore a rotor is arranged, and with a control arrangement having at least one coil with a core passed by the motor current. The coil shall be arranged in a space saving manner without interfering too much with the magnetic field of the motor. To solve this problem the core of the coil is arranged on the stator whose iron is used for a magnetic circuit.

1. The invention concerns an electric motor with a stator, in whose bore a rotor is arranged, and with a control arrangement having at least one coil with a core passed by the motor current. The coil shall be arranged in a space saving manner without interfering too much with the magnetic field of the motor. To solve this problem the core of the coil is arranged on the stator whose iron is used for a magnetic circuit.

Fig.1

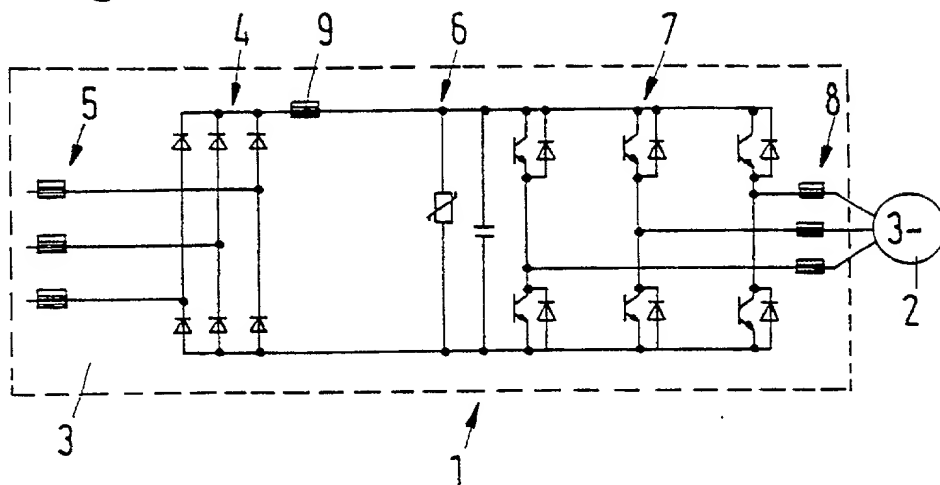
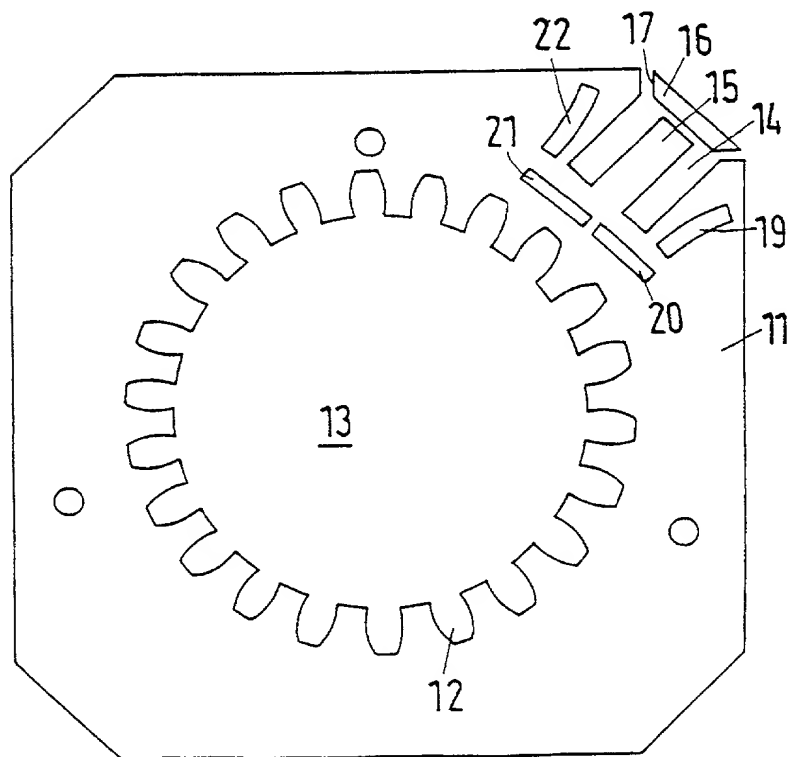


Fig.3



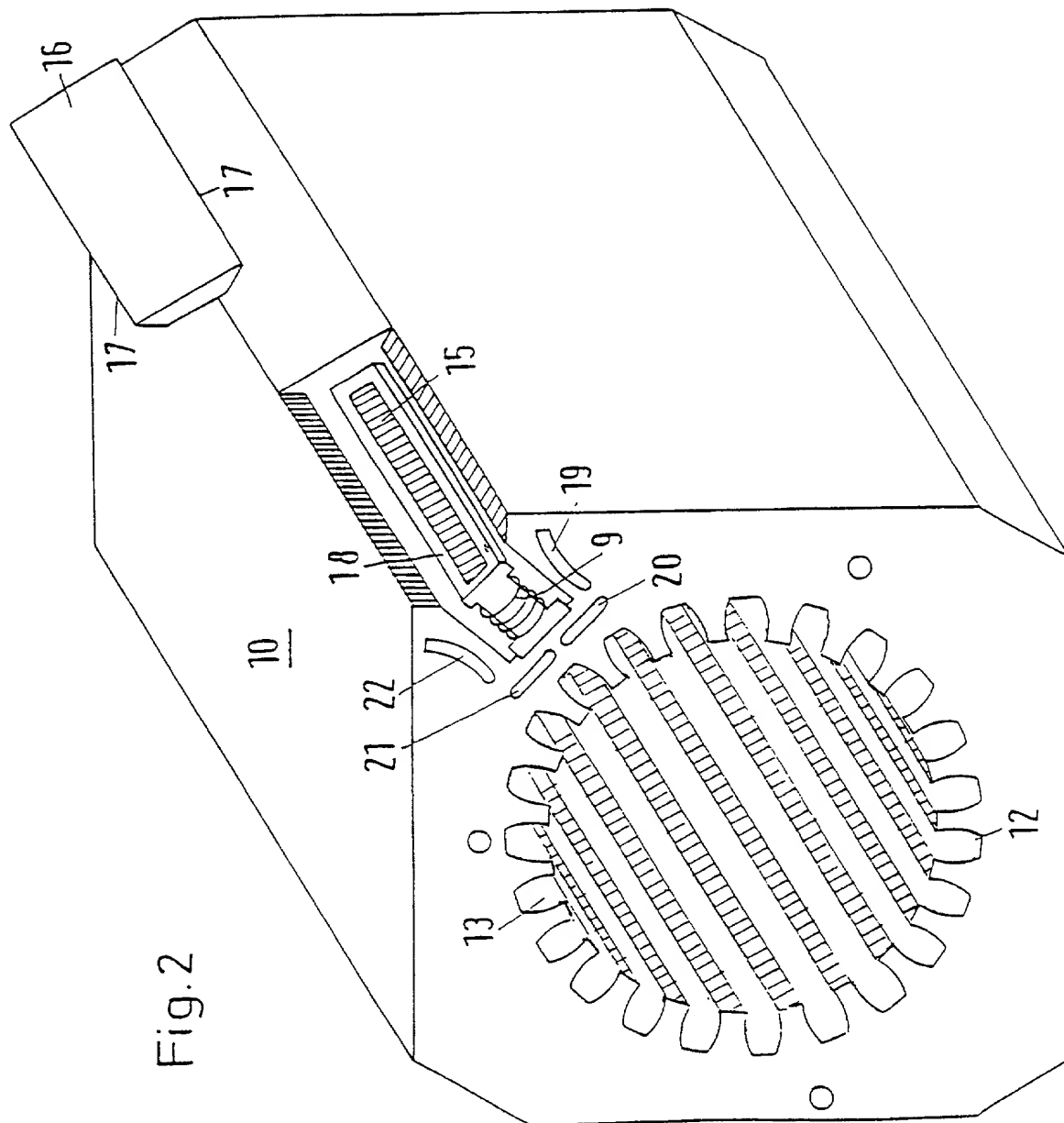


Fig. 2

Fig. 4

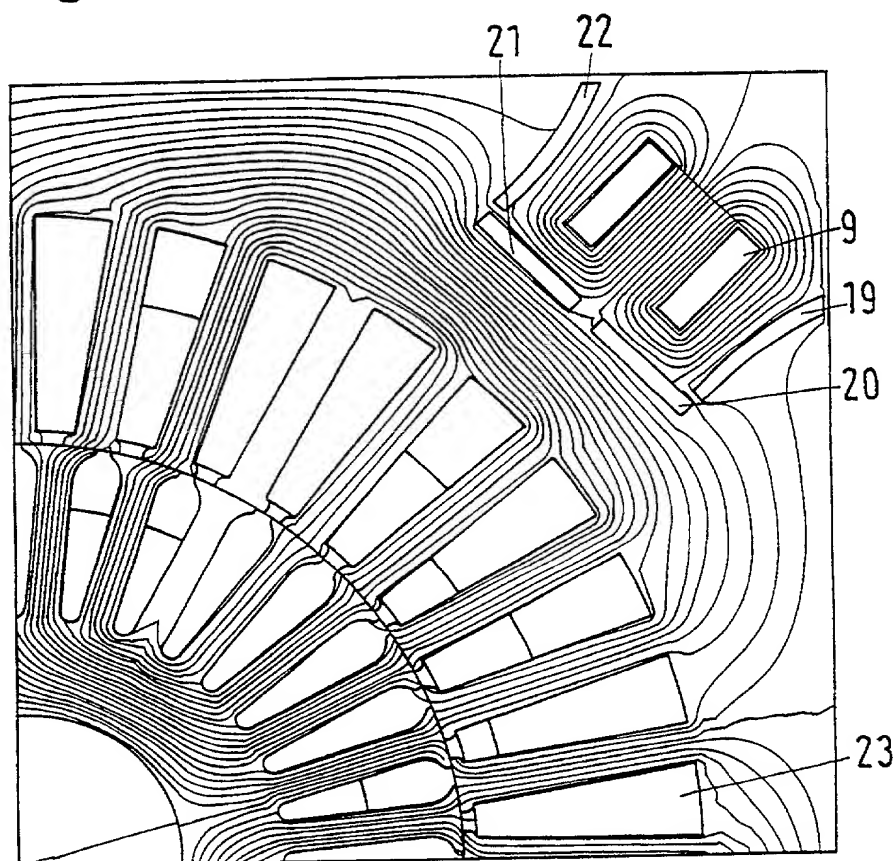
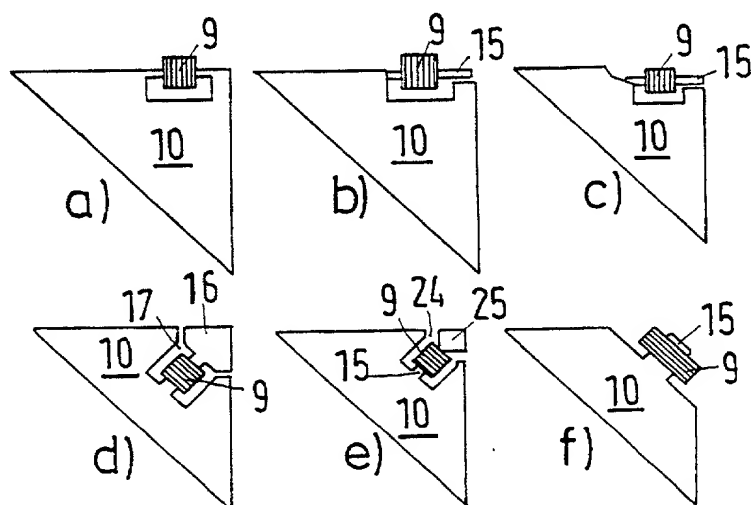


Fig. 5



09/331501

510 Rec'd. PCT/PTO 14 JUN-1999

196-1182

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE THE APPLICATION OF)
Ole Mathiassen)
SERIAL NO. TO BE ASSIGNED)
FILED: HEREWITH)
FOR: ELECTRIC MOTOR)

SUBMISSION OF FORMAL DRAWINGS

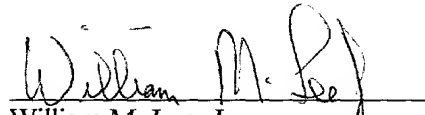
Honorable Commissioner of
Patents and Trademarks
Washington, D.C. 20231

Dear Sir:

Submitted herewith are three sheet(s) of formal drawings for the above-identified application.

June 14, 1999

Respectfully submitted,


William M. Lee, Jr.
Registration No. 26,935

Lee, Mann, Smith, McWilliams,
Sweeney & Ohlson
P.O. Box 2786
Chicago, Illinois 60690-2786
(312) 368-1300
Facsimile (312) 368-0034



Attorney Docket No.

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled ELECTRIC MOTOR, the specification of which:

___ is attached hereto.

X was filed on December 12, 1997 as PCT International Application Serial No. PCT/DK97/00564 and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119 of any foreign application(s) for patent or inventor's certificate listed below and have

also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

PRIOR FOREIGN APPLICATION(S)

<u>Country</u>	<u>Number</u>	<u>Date Filed</u>	<u>Priority Claimed</u>	
			<u>Yes</u>	<u>No</u>
<u>Germany (DE)</u>	<u>196 52 186.6</u>	<u>December 14, 1996</u>	<u>X</u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

I hereby claim the benefit under Title 35, United States Code Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, Section 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

<u>Application Serial No.</u>	<u>Filing Date</u>	<u>Status</u>
<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>

12 And I hereby appoint Wm. Marshall Lee, Registration No. 16,853, John M. Mann, Registration No. 17,775, Thomas E. Smith, Registration No. 18,243, Dennis M. McWilliams, Registration No. 25,195, James R. Sweeney, Registration No. 18,721, William M. Lee, Jr., Registration No. 26,935, Glenn W. Ohlson, Registration No. 28,455, David C. Brezina, Registration No. 34,128, Jeffrey R. Gray, Registration No. 33,391, Timothy J. Engling, Registration No. 39,970, Gregory

B. Beggs, Registration No. 19,286, Gerald S. Geren, Registration No. 24,528 and Peter J. Shakula, Registration No. 40,808 as my attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith. It is requested that all communications be directed to Lee, Mann, Smith, McWilliams, Sweeney & Ohlson, P.O. Box 2786, Chicago, Illinois 60690-2786, telephone number (312) 368-1300.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole inventor:

Mathiassen, Ole

Signature _____

Date 25-8-99

"Ole Mathiassen by Ib Mathiassen, Executor"

Country of Residence: Denmark DKX

Country of Citizenship: Denmark

Post Office and Residence Address:

Toftevej 22
DK-7700 Thisted

Grundafn. 005244 01 0001.2173
60000-00047/1999

26.08.1999 RA
200,00 f